

U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS—MILTON WHITNEY, Chief.

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# SOIL SURVEY OF ORANGE COUNTY, FLORIDA.

BY

J. E. DUNN, IN CHARGE, MARK BALDWIN, AND CHARLES N.  
MOONEY.

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W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

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[Advance Sheets—Field Operations of the Bureau of Soils, 1919.]



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1922.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS—MILTON WHITNEY, Chief.

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## LETTER OF TRANSMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,  
*Washington, D. C., October 19, 1921.*

SIR: I have the honor to transmit herewith the manuscript report and map covering the soil survey of Orange County, Fla., and to recommend that they be published as advance sheets of Field Operations of the Bureau of Soils, 1919, as authorized by law.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

Hon. H. C. WALLACE,  
*Secretary of Agriculture.*



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# SOIL SURVEY OF ORANGE COUNTY, FLORIDA.<sup>1</sup>

By J. E. DUNN, In Charge, MARK BALDWIN and CHARLES N. MOONEY.—  
Area Inspected by W. EDWARD HEARN.

## DESCRIPTION OF THE AREA.

Orange County is situated in the north-central part of the Florida Peninsula, about 150 miles south of Jacksonville and nearly 100 miles northeast of Tampa. It is bounded on the east by the St. Johns River. In a north-south direction it has a maximum length of 30 miles and its greatest width is about 48 miles. It has an area of 899 square miles, or 575,360 acres.

In general, the surface of Orange County is level to gently rolling and characterized by numerous lakes and swampy areas. Two distinct physiographic regions are recognized, though the boundary between them is indefinite. In general, the northwestern part of the county is rolling, with numerous lake basins and sink holes, but in no place are the slopes sufficiently steep to prevent agricultural use. The eastern and southern parts of the county lie in what is locally termed the flatwoods. Here there are numerous very shallow depressions, giving little relief to the generally flat character of the country. The general elevation of the lake region is about 100 feet higher than that of the flatwoods. The higher land in the city of Orlando is approximately 125 feet above sea level, while the eastern part of the county is estimated to be from 15 to 25 feet above sea level.

The drainage of the lake region is chiefly underground, the water percolating through the sandy soils into underground channels and finding its way out into surface drainage ways through numerous springs. Most of the lakes of the region are part of the drainage system. Wekiva Springs, in the northwestern part of the county, form the source of one branch of the Wekiva River, a tributary of



FIG. 1.—Sketch map showing location of the Orange County area, Florida.

<sup>1</sup> In the present survey the base map was compiled from a plane-table traverse made during the progress of the soil survey, and from the official map of the county. That part of the county included in ranges 27, 28, 29, 30, and 31 east was mapped in detail. Owing to the high water during the period of the survey, the area in ranges 32, 33, and 34 east was covered in less detail, the areas of the various soils were less definitely determined, and they often include considerable areas of soil types other than those indicated on the map.

the St. Johns River. Lake Apopka, on the western boundary of the county, is drained by a branch of the Ocklawaha River, a member of the St. Johns drainage system. The flatwoods section of the county is poorly drained, much of the land being covered or saturated with water during a large part of the year. The streams are generally sluggish and bordered by extensive swamps; the water is generally of a brownish color, owing to the presence of organic matter in solution. The southwestern part of the county is drained by tributaries of the Kissimmee River, which flows southward into Lake Okeechobee. The entire eastern part of the county lies within the drainage basin of the St. Johns River. Its largest tributary is Contoohatchee River, which extends across the county through range 32 east.

Artificial drainage by the construction of ditches and drainage wells has resulted in the reclamation of many small tracts of land throughout the county. More extensive projects have been planned to reclaim the Peat area north of Lake Apopka and the Peat and Muck lands around Hart Lake.

The first settlers in this region came chiefly from other parts of Florida and from neighboring States, mainly Georgia. A considerable number, however, came from northern States. Practically all the early settlers were native-born Americans of English descent. The more recent immigration has been from all parts of the United States, and has included only a small number of foreigners. According to the United States census, the total population in 1920 was 19,890. The county seat, Orlando, is the largest city in the county, with a population in 1920 of 9,282. Other towns of local importance are Apopka, with a population of 798; Winter Park, with 1,078; Winter Garden, with 1,021; Oakland, with 323; Taft, with 259; and Maitland, with 172. The normal population is greatly augmented during the winter by tourists from the north.

Orange County is traversed by several railroads. The main line of the Atlantic Coast Line from Jacksonville to Tampa traverses the central part of the county, passing through Maitland, Winter Park, Orlando, and Taft. Farther west a branch line from Apopka runs southward through Ocoee, Gotha, Windermere, and Orange Center, to join the main line at Kissimmee in Osceola County. Another branch of the Atlantic Coast Line passes through Winter Garden and Oakland. One branch of the Seaboard Air Line runs northwestward from Orlando to Ocala, and another northeastward through Winter Park to Oviedo. The Okeechobee Branch of the Florida East Coast Railway traverses the eastern part of the county. The Travares & Gulf Railway extends westward from Ocoee.

The roads in the more highly developed sections of the county are generally well improved, about 70 miles of brick highway radiating

in all directions from Orlando. Other roads are improved with sand-clay surfacing, and in places pine needles are used as surfacing material. The roads in the flatwoods section are generally unimproved, and at times they are almost impassable.

The principal local markets for the farm products of Orange County are Orlando, Maitland, Winter Park, and Apopka. Shipments of citrus fruits and truck are made in carload lots to northern cities. With the growth of the towns, the increasing tourist trade from the North, and the improvement of the roads and means of transportation, marketing facilities are constantly improving.

#### CLIMATE.

The climate of Orange County, like that of all inland Florida, is generally mild and of a subtropical character, with a heavy annual precipitation. The winters are usually pleasant and quite healthful and attract many tourists and health seekers each year. Climate has been the chief factor in causing large numbers of persons to make this their permanent residence. The climatic conditions are also favorable for growing a wide range of crops, as the growing season is long and there is an abundance of rainfall. However, on account of soil conditions, only a few crops are grown successfully. Of these, truck crops and citrus fruits, which are the principal items in the agriculture, owe their success in large part to the climate.

The mean annual precipitation as recorded at Orlando is 51.57 inches, with a range from 74.19 inches for 1905, the wettest year on record, to 36.90 inches for 1898, the driest year. Approximately two-thirds of the rainfall occurs between June and October, inclusive. The summer rains are usually sudden showers, occasionally of a torrential character, and are of almost daily occurrence during a part of the season. In the winter the rains are more gentle, usually of several days' duration, and generally followed by considerable periods of fair weather. Short droughts may occur at any time during the year, and at such times crops on the sandy, well-drained soils may suffer. On account of this tendency to drought, some of the truck farmers and a few citrus growers have installed irrigation systems for temporary protection. Violent hail, thunder, and wind storms are rare, and dense fogs are rather unusual. Snow is unknown.

The mean annual temperature is 71.7° F., with an absolute maximum of 101° and an absolute minimum of 18°. The mean winter temperature is 60.6° F., and that of the summer 81.5° F. High temperatures prevail during the late spring, summer, and early fall months, and extremes of 98° F. to 100° F. are often reached during the midday and afternoon. On account of the high humidity the heat is quite oppressive in the daytime, but the nights are seldom

hot. Usually after a rain in the winter a few days of cold or cool weather may be expected.

The latest recorded killing frost in the spring at Orlando occurred on March 23, and the earliest in the fall on November 18. The average date of the last killing frost in the spring is February 7, and that of the first in the fall, December 21. This gives a growing season of 317 days. In normal years the frosts are not severe, except in the low, flat depressions and other unfavorable localities. In most places hardy truck crops, such as lettuce, celery, and cabbage, can be grown successfully throughout the winter. Although the citrus industry is quite well developed, considerable attention must be given to air drainage and other influences in the location of the grove to avoid injury from freezes. Occasionally during the past the citrus industry has suffered severely from extreme cold. In 1894 and 1895 most of the bearing trees were completely killed, and in 1885 many groves were severely damaged.

The following table, compiled from the records of the Weather Bureau at Orlando, gives the normal monthly, seasonal, and annual temperature and precipitation. Conditions at this station are typical of the greater part of Orange County:

*Normal monthly, seasonal, and annual temperature and precipitation at Orlando.*

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1898).	Total amount for the wettest year (1905).
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December.....	60.6	86	18	2.15	3.68	8.43
January.....	59.8	85	21	2.72	.64	.41
February.....	61.3	89	19	2.74	1.26	2.12
Winter.....	60.6	89	18	7.61	5.58	10.96
March.....	67.3	97	32	2.34	.54	5.13
April.....	71.0	98	41	2.02	.15	1.71
May.....	76.9	100	51	3.81	1.19	8.12
Spring.....	71.7	100	32	8.17	1.88	14.96
June.....	80.4	100	59	7.26	1.13	8.13
July.....	82.1	100	64	7.25	7.31	6.15
August.....	82.1	101	63	7.15	10.93	17.13
Summer.....	81.5	101	59	21.66	19.37	31.41
September.....	79.5	98	50	7.39	3.43	13.11
October.....	73.7	98	41	5.15	5.55	3.42
November.....	66.5	90	28	1.59	1.09	.33
Fall.....	73.2	98	28	14.13	10.07	16.86
Year.....	71.7	101	18	51.57	36.90	74.19



AGRICULTURE.<sup>2</sup>

Agriculture in Orange County began with the first settlement. The pioneer agriculture was confined to the better drained parts of the county, and was of the self-sustaining type. Corn and cotton were the principal crops. The corn was ground into meal or fed to stock. A cotton gin was established at a comparatively early date in the vicinity of Orlando. Corn has continued to be grown to the present time, but the growing of cotton was practically abandoned until 1918, in which year about 2,000 acres of sea-island cotton were planted. The crop produced fairly well, but on account of market conditions only 40 acres were planted in 1919.

The stock industry began quite early, as the greater part of the county was open range, which afforded considerable grazing. All the early farmers raised hogs and cattle. Stock farming continued to grow, and at the present time it is a rather important industry. Many farmers depend solely upon live stock for their income, and much of the county is used only for range purposes. It requires about 30 acres of range land to support a cow, and the 1920 census states that the county has 13,072 head of cattle. According to the same authority there are 2,121 dairy cattle in the county, but the dairy industry has not developed, except in the vicinity of the larger towns, where it is carried on to supply local demands.

Most of the early settlers planted a few orange trees around their houses, but it was not until the seventies that citrus fruits were planted commercially. Since then the citrus-fruit industry has developed rapidly, and while there have been several setbacks as a result of freezes in 1885, 1894, and 1895, it is now recognized as the most important source of income. According to the Fourteenth Biennial Report of the State Department of Agriculture the county had, in 1915-16, 469,393 bearing and 235,258 nonbearing orange trees, and 76,505 bearing and 79,533 nonbearing pomelo (grapefruit) trees. The United States census for 1920 reports 284,994 orange trees not of bearing age and 432,262 of bearing age, 32,987 nonbearing and 62,994 bearing grapefruit trees, the number of boxes of oranges and grapefruit harvested totaling 946,605.

The production of field crops, particularly truck crops, has also developed as transportation facilities have improved. At the present time (1919) trucking is probably the second largest source of income. It is confined to the western half of the county and is best developed in the locality of Winter Garden, around Lake Apopka. The chief crops are lettuce, cucumbers, cabbage, Irish potatoes, and tomatoes, probably ranking in importance in the order named.

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<sup>2</sup> Statistics given in this report are based on statements of farmers, field observations, U. S. Census reports, report of the Department of Agriculture of the State of Florida, and statements of the county farm adviser.

Two crops of lettuce are usually obtained annually. The first setting is made in October and the second in December. The principal varieties are the New York, Baltimore, and Big Boston. The yields vary from about 300 to 700 baskets per acre. In 1915-16, 258 acres were devoted to lettuce. It is the common practice to follow lettuce with cucumbers, the crop maturing during the last half of April and the first half of May. A total of 245 acres was planted to this crop during the season of 1915-16, and the estimated production was 36,352 crates.

Cabbage is set out from September to December, and marketed from December to April. Yields vary from 100 to 300 crates per acre. The principal varieties grown are the Charleston Wakefield and Late Flat Dutch.

The spring crop of Irish potatoes is planted in January and February, and dug the latter part of April or the first part of May. As in the case of the other truck crops, all the spring crop is shipped to northern markets, but a fall crop is usually planted for local winter use. The most popular varieties of potatoes are the Bliss and Spalding No. 4. Yields are subject to much variation, but ordinarily range from 50 to 100 barrels per acre.

Tomatoes are usually planted in March. They yield about 150 crates per acre. The principal varieties grown are the Earliana and Globe. In 1915-16 a total of 129 acres was planted in this crop.

Muskmelons and watermelons are grown commercially, and small quantities of peppers, eggplant, and strawberries are produced.

Corn is the most important general field crop. The prolific varieties and Cuban Flint are grown principally. In 1918 about 8,000 acres were planted. The yield of grain varies from 15 to 20 bushels per acre. A part of the crop is used for silage. The United States census for 1920 reports 3,525 acres in corn, with a yield of 56,563 bushels, and 71 acres, yielding 21 tons, of corn cut for forage.

This region is not well suited to the production of hay and forage crops, but in 1918 almost enough hay was produced to supply the local needs. The principal hay crops are beggarweed, crab grass, and peavine. Velvet beans and cowpeas are the principal legumes.

The farmers of this county recognize to some extent that certain soils are best for particular crops. The orange groves are confined to the soils of the Orlando and Norfolk series. In selecting a grove site much attention is also given to the air drainage and the location with respect to lakes. Irrigation is often used for truck crops; a system is usually installed which will afford both drainage and irrigation. Generally in selecting a field preference is given to a site where the system can be installed economically and successfully, and the character of the soil is a secondary consideration. It is necessary



to give some attention to frost conditions. The soils of the Orlando series are generally recognized as the best trucking soils in the county.

Very little attention is given to crop rotation, as most of the cultivated area is used for special crops. In the trucking districts a common crop succession is: Two crops of lettuce, followed by cucumbers, and then by corn, a crop of crab-grass hay often being cut when the corn is harvested. In this way five crops are obtained in one season.

Much fertilizer is used in farming operations. According to the census, \$520,756 was expended for fertilizers in 1919. Manure is used whenever available, but very little is produced. All the citrus-fruit growers use fertilizer, and many of them make three applications during the year, in January–February, May, and October. The first application is an 8-4 mixture,<sup>3</sup> or when potash is available an 8-4-10 or 8-4-12 mixture. The nitrogen content is reduced about 1 per cent for the second application, and still further for the third. Potash when obtainable is generally increased in the third application. The amount of fertilizer varies with the age of the trees and the character of the soil. Usually it ranges from 20 to 45 pounds per tree for the season. Some growers consider that 5 pounds of fertilizer per year is necessary for every box of fruit produced. In the trucking regions the growers usually make a very heavy application for the first crop, and this serves during the whole season. In the beginning of the season it is quite common to apply about 1 ton of hardwood ashes per acre, one-half ton of tankage, and one-half ton of commercial fertilizer analyzing 9-5-2. Sometimes the tankage is omitted and 1 ton of commercial fertilizer is used. The fertilizer mixtures and rates of application for Irish potatoes vary, but the average rate is about 1,200 pounds per acre and the usual composition 9-5-3. Sweet potatoes ordinarily are grown without fertilizer; a few growers apply a small quantity, 200 or 300 pounds per acre. Tomatoes receive about 700 pounds per acre of an 8-4-3 mixture.

In normal times farm labor is rather plentiful and can be obtained at a fair price. The negro population furnishes much of the labor, but in certain sections some white laborers are employed.

In 1920, 40.8 per cent of the area of Orange County was in farms, with an average size of 221.8 acres. In that year 90.4 per cent of the farms were operated by owners, 3.8 per cent by tenants, and 5.8 per cent by managers.

The selling price of farm lands varies widely in different parts of the county, depending upon the location, crop adaptation, kind of soil, and state of improvement. Some of the better orange groves in bearing sell for more than \$1,000 an acre. Good trucking land with an efficient irrigation and drainage system and good location sells

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<sup>3</sup> 8 per cent phosphoric acid and 4 per cent nitrogen.

for about \$1,000 an acre. The greater part of the county, however, consists of flatwoods land, the price of which ranges from \$5 to \$15 an acre, depending largely upon its timber and grazing values. The 1920 census gives the average assessed value of farm land as \$50.86 an acre.

#### SOILS.

Orange County lies within the Coastal Plain region of the State. The underlying rock, chiefly limestone, is exposed in very few places, and it does not influence the character of any of the soils except locally. It is important, however, because through its solution there has been developed the sink-hole topography and the resulting lake region of the western part of the county. The surface material, from which the soils have been derived, consists of unconsolidated marine deposits made up of various grades of sand, sandy clay, and clay, supplemented in certain poorly drained positions by accumulations of vegetable matter.

On the basis of origin the soils may be classed in two main groups, those derived almost wholly from the sedimentary materials and those composed mainly of vegetable matter in various stages of decay with only relatively small quantities of mineral matter. Soils of the first group are divided into eight soil series, the St. Lucie, Norfolk, Orlando, Plummer, Portsmouth, Leon, St. Johns, and Bladen. The differences between these series are chiefly in color, structure, topography, drainage conditions, and content of organic matter. The series is subdivided into soil types in which texture is the basis of separation.

The members of the St. Lucie series are characterized by a white color in both soil and subsoil. The St. Lucie soils occupy slight ridges and knolls, and are loose in structure and extremely droughty. They support a scrubby growth of vegetation. Only one type, the fine sand, is mapped in this county.

The members of the Norfolk series have gray surface soils and pale-yellow to brownish-yellow subsoils. These are among the most important soils of the Coastal Plain region of the United States. They occupy rolling to undulating areas and are usually well drained. The Norfolk fine sand, with a hammock phase, and the Norfolk sand occur in Orange County.

The surface soils of the types included in the Orlando series are relatively high in organic matter, and dark gray to almost black in color. The subsoils are gray, becoming yellowish gray in the lower part of the 3-foot section. The members of this series are closely associated with the Norfolk and Portsmouth soils, but they carry a much higher percentage of organic matter than the Norfolk and are much better drained than the Portsmouth. The Orlando fine sand and a black phase of this type are mapped in Orange County.

The Plummer series is characterized by a light-gray or dull-gray surface soil and a light-gray to almost white subsoil. The members of this series occupy flat areas and are always poorly drained. The fine sand, with a cypress-swamp phase, is mapped in Orange County.

Portsmouth soils are black to dark gray, and the subsoils are light gray or mottled gray and yellow. These soils contain a high percentage of organic matter. They occupy flat areas and depressions and are poorly drained. Only one type, the Portsmouth fine sand, is mapped in this county.

The Leon series is characterized by a light-gray to almost white surface soil, underlain at a depth of 1 or 2 feet by a dark-brown to almost black, compact hardpan layer which is composed chiefly of sand cemented with organic matter and iron. This hardpan is the most conspicuous feature of the series. It is usually a few inches in thickness and is underlain by a lower subsoil of brownish-yellow to white sand. The soils of this series occupy flat or nearly level areas and are poorly drained. The fine sand is the only member of the series mapped in this survey.

The St. Johns series differs essentially from the Leon series in that the surface soil is black, owing to a larger content of organic matter. Like the Leon, it has a hardpan stratum, lying in many places near the surface, and the lower subsoil is almost identical with that of the Leon series. The St. Johns soils occupy low, flat, poorly drained areas where conditions have favored a rank growth of vegetation. They lie slightly lower than the Leon soils. In some of the earlier surveys the St. Johns soils were mapped as Portsmouth, but later study has shown them to be distinct. The St. Johns fine sand is the only member of the series in this county.

The surface soils of the Bladen series are dark gray to brownish gray and the subsoils are gray or mottled with yellow and brown. The members of this series occupy the lower lying parts of the upland, and in many cases represent the most recently formed material. They occupy flat areas and are naturally poorly drained. In many places they lie only a few feet above the normal water level of the streams. The Bladen fine sand, with a hammock phase and a prairie phase, and the Bladen fine sandy loam are mapped in Orange County.

The cumulose soils, those composed principally of organic matter in various stages of decomposition, have been developed in low situations where conditions have favored the growth of vegetation, the remains of which have accumulated in some places to considerable depths. These deposits have been divided into three types, Peat, Peaty muck, and Muck. Peat consists of brown, fibrous to semifibrous plant remains which have accumulated under water and which have undergone only partial decomposition, the amount of

mineral matter being relatively small. Peaty muck represents a further stage of decomposition in which the peat is mixed with more sand and clay, and in some places may be an admixture of Peat and Muck. Muck consists of black, well-decomposed vegetable matter which has become mixed with about an equal proportion of mineral matter, ranging from sand and fine sand to clay.

Swamp represents first-bottom or low-lying soils so variable in texture that the included types could not be separated.

A number of shallow lakes supporting a growth of coarse grasses are mapped as Water and grass.

In following pages of this report the various soils of Orange County are described in detail, and their relation to agriculture discussed. The distribution of the various soils is shown on the accompanying map; their actual and relative extent are given in the following table:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Leon fine sand.....	149,888	26.1	Peaty muck.....	20,992	3.6
Norfolk fine sand.....	102,080	18.4	St. Lucie fine sand.....	17,728	3.1
Hammock phase.....	3,776		Peat.....	15,296	2.7
St. Johns fine sand.....	78,400	13.6	Norfolk sand.....	10,688	1.9
Swamp.....	49,920	8.7	Portsmouth fine sand.....	7,424	1.3
Bladen fine sand.....	36,928	8.5	Muck.....	3,008	.5
Hammock phase.....	7,808		Water and grass.....	2,880	.5
Prairie phase.....	3,968		Bladen fine sandy loam.....	2,368	.4
Plummer fine sand.....	19,712	6.9	Total.....	575,360	.....
Cypress-swamp phase.....	20,416				
Orlando fine sand.....	21,184	3.8			
Black phase.....	896				

#### ST. LUCIE FINE SAND.

The St. Lucie fine sand consists of a white, siliceous fine sand, very loose and open in structure. The content of organic matter is exceedingly low, and in most places there is only a trace, insufficient to impart even a light-gray color at the surface. The subsoil is similar to the surface material in color, texture, and structure, and continues uniform to depths below 3 feet. The type is subject to considerable variation in texture and as mapped in the vicinity of Orange Center and Sand Lake it includes numerous areas of medium sand.

The St. Lucie fine sand is confined largely to the central and western parts of the county, in the general region where the Norfolk soils predominate. The areas are smaller, more irregular, and more scattered than those of the Norfolk fine sand. The type is best developed and most extensive in the region between Turkey Lake and



Zante, in the vicinity of Sand Lake, and northeast of Ocoee. Numerous small bodies are found northeast of Orlando, between Orlando and the northwest corner of the county, and between Golden Rod and Lake Pickett station.

The type occupies nearly level to slightly undulating areas, which in places become somewhat hummocky and ridgy. The drainage is always excessive, owing mainly to the loose structure and coarse texture, and the type is very droughty. Even after a heavy rainfall it remains moist only for a short time.

The native forest consists mostly of spruce pine, with a very dense undergrowth of shrubs and brush, among which scrub live oak is one of the more abundant species. The leaves on this oak are small, thick, and leathery, and the whole vegetation is of a semiarid character. A scattering growth of prickly-pear cactus is encountered in a few places. The peculiar flora is one of the striking characteristics of the type; practically all of the areas mapped are easily recognized by their distinctive vegetation.

At present the St. Lucie fine sand has a very low agricultural value. It is practically worthless for the production of farm crops and fruits in this county, and none of the areas are cultivated, but along the Florida east coast pineapples have been grown on this type with heavy applications of fertilizer.

#### NORFOLK SAND.

The surface soil of the Norfolk sand is prevailingly gray or light gray, with a brownish-gray cast in places. Like the Norfolk fine sand, the soil is darker when wet and becomes light gray when dry. It varies in depth from 3 to 12 inches. The material is very loose and easy to till, and for a sand is quite retentive of moisture. The content of organic matter is low. The subsoil is similar to the surface soil in texture and structure, but has a distinct, bright-yellow to brownish-yellow color which continues uniform to depths below 36 inches.

The type is subject to considerable textural variation, grading from a fine sand on the one hand to a coarse sand on the other. In places rather large quartz particles are found throughout the soil mass.

The Norfolk sand is not extensive, but it is the predominating soil in the southwestern part of the county. It occupies rolling areas and as a whole is more undulating than the Norfolk fine sand. Numerous lakes and a few potholes are scattered throughout its extent. Drainage ranges from good to excessive.

The native vegetation consists largely of blackjack oak, longleaf pine, scattered turkey oak, and a little live oak. The greater part of

the pine, however, has been removed by lumbermen. In places wire grass makes a fairly good growth and furnishes some grazing.

Only a small area of the Norfolk sand is used for agriculture, although its productiveness is very little, if at all, lower than that of the Norfolk fine sand. Part of the type could be used for growing citrus crops, but it is all somewhat isolated from markets and confined to a region where the wagon roads are poor. The selling price of the land in its native state is a little lower than that of the Norfolk fine sand.

#### NORFOLK FINE SAND.

The Norfolk fine sand to a depth of 4 to 10 inches typically consists of a light-gray or gray to brownish-gray fine sand overlying a very pale yellow to yellow fine sand subsoil. The latter continues uniform in color to depths below 3 feet, and shows little change in texture or structure from the surface soil. The soil contains a small amount of organic matter, and in uncleared areas the upper inch or two is apt to contain more than typical, owing to the accumulation of leaf mold and other plant remains. The content is relatively high also in some of the flatter, more depressed areas. Here the surface soil is usually darker in color and has a more loamy character. The soil is generally quite loose, and roads are apt to become very sandy in dry weather, but in some places the material has sufficient coherence to stand alone in vertical cuts.

In the region between Apopka and Zellwood, and south of Johns Lake the type is subject to considerable textural variation. It becomes much coarser in places, approximating medium sand. Here the surface is usually more rolling, and the subsoil is bright yellow, orange, or brownish yellow. In the vicinity of Lockhart and in the areas east of Lake Apopka the type is often underlain by a very compact, sticky sandy clay or clayey sand formation, which in many places comes within 4 or 5 feet of the surface. This material is used quite extensively in making sand-clay roads. It is much mottled with gray, brown, and yellow, and varies considerably in texture. It is separated from the overlying material by a very distinct line of demarcation. Where this stratum is not too deep, the productiveness of the type is greatly enhanced.

The Norfolk fine sand is closely associated with the Orlando fine sand and Norfolk sand, and in places these three soils merge into each other. Doubtless small areas of the other two types are mapped with the Norfolk fine sand in places, and vice versa.

The Norfolk fine sand is one of the most extensive and most important agricultural soils in the county. It is largely confined to the western half, and is best developed in the section between Orlando and the northwestern corner of the county. It is the predominant

soil north of Turkey Lake, and between Turkey Lake and the county boundary on the west. Numerous irregular areas are mapped in the vicinity of Winter Park, south of Golden Rod, and east of Golden Rod along the north county boundary to the Florida East Coast Railroad. A few areas occur north and south of Conway and in the vicinity of Sand Lake.

The type occupies rolling to undulating areas in the lake region of the county. A few areas are level or nearly so, but they are small in extent. The sandy texture of the soil, together with its surface relief, cause excellent drainage, and drainage is excessive on some of the higher lying areas. The type, however, is quite retentive of moisture for a fine sand. The tree growth of virgin areas consists mostly of longleaf pine and blackjack oak. The greater part of the pine has been removed for lumber, and in such places the oak has become thicker. A scattered growth of willow oak and live oak is present in a few places, and wire grass grows quite well where the forest is not too thick. The native vegetation on this type stands out in strong contrast to that on the lower lying, poorly drained soils.

The Norfolk fine sand is recognized as one of the most important citrus soils in the State of Florida. The numerous lakes make it easy to find good grove sites, as they reduce the danger from frosts. This soil is used quite extensively in parts of the United States for trucking, but so far in this county it has been used in only a small way for this purpose. Cotton, corn, velvet beans, cowpeas, Irish potatoes, sweet potatoes, and sugar cane are grown to a small extent.

Heavy applications of fertilizer are generally made for all crops. A few irrigation systems have been installed on the truck farms. The greater part of the type is not used for agriculture. It remains in its virgin state, in which condition it has some value for grazing.

Land values are subject to wide variation, depending upon the location, distance to markets, roads, topographic position, and degree of development. Some of the best bearing orange groves on this soil sell for as much as \$1,000 an acre, while areas of the type in the virgin state remote from settlement could probably be purchased for \$20 to \$25 an acre.

*Norfolk fine sand, hammock phase.*—The hammock phase differs from the typical Norfolk fine sand in its native vegetation and in its topographic position. It is locally known as "hammock land," and in its virgin state supports a thick, vigorous stand of live oak, with some magnolia and a dense undergrowth of briers and shrubs. The clearing of the land for cultivation is costly. The phase is usually developed around the borders of lakes or around low-lying areas like the body of Peat north of Lake Apopka. It has a flat to slightly sloping topography which merges into the rolling areas occupied by the typical Norfolk fine sand.

The soil is usually a dark-gray fine sand, changing at 6 to 10 inches to light gray and passing at depths between 12 and 24 inches into a pale-yellow or yellowish-gray subsoil. In most places the subsoil is identical in color and texture with that of the typical Norfolk fine sand. The soil contains more organic matter than the typical Norfolk fine sand, is more loamy and compact, and as a whole is more retentive of moisture. Crop yields are generally higher.

The phase is closely associated with the Orlando and Norfolk soils, and occurs in small, irregular areas in the vicinity of Lake Apopka and Johns Lake, and southeast of Zellwood. It is also well developed around some of the lakes in the vicinity of Winter Park and Maitland. A number of areas are mapped north of Apopka, near Piedmont, and around Lake Conway.

On account of its favorable topographic position and soil, this phase is used mainly for the growing of citrus fruits. It supports some of the best bearing groves in the county. It is also a good trucking soil. The same methods of cultivation and fertilization are practiced as on the Orlando and Norfolk fine sands.

#### ORLANDO FINE SAND.

The Orlando fine sand, to a depth of 12 to 18 inches, consists of a dark-gray to almost black, smooth-textured, rather loamy, moderately loose fine sand. When wet the material is almost black, but upon drying the immediate surface material becomes gray. The subsoil is similar to the surface soil in texture and structure, but is much lighter in color, being gray, and in many places, in the lower part of the 3-foot section, yellowish gray. The soil contains more organic matter than the Norfolk soils, and, considering its texture, is retentive of moisture. It is easily tilled and readily permeable to roots and water.

This type is closely associated with the Norfolk fine sand, and in places the boundary between the two is rather indefinite, owing to the gradual merging of the one type into the other. Doubtless some small areas of the Norfolk fine sand are mapped with this type.

The Orlando fine sand is most typically and most extensively developed between Orlando and Conway. It also occurs along the eastern and southern shores of Lake Apopka and in the section between Johns Lake and Gotha. Other areas are mapped in the vicinity of Ocoee, around Fairvilla, and north of Orlando.

The type occupies nearly level to slightly undulating areas, in many places containing lakes. Good drainage prevails as a result of the loose structure and sandy texture of the soil and subsoil.

The natural tree growth on this soil is principally longleaf pine. Willow oak, scattered live oak, and some blackjack oak are present in places. The greater part of the type is under intensive cultiva-



tion. It is one of the best soils in Orange County and is well adapted to the production of oranges, grapefruit, and other citrus fruits. It is also well suited to the production of truck crops. Heavy applications of fertilizer are usually made and the soil is handled in the same manner as the Norfolk fine sand.

Land prices vary widely, but it is not unusual for farms with a good bearing orange grove in a well-developed region to sell for \$1,000 an acre.

*Orlando fine sand, black phase.*—The black phase of the Orlando fine sand consists of a black, loamy fine sand extending to depths below 36 inches. As a whole it contains more organic matter than the typical soil, and is not so loose and porous. The soil is easily tilled and has a good water-holding capacity. In some places the lower part of the 3-foot section is lighter in color than the surface material.

This phase is not extensive. It occurs in close association with the typical soil, commonly around or near lakes. Several areas are mapped within and near the city of Orlando. The phase is also found around Lake Virginia and east of Winter Park, and two small areas are mapped north of Lake Conway. It occupies flat to nearly level areas, and probably is a little lower lying than the typical soil. The drainage is generally good, though slightly poorer than that of the typical Orlando fine sand. The phase has about the same agricultural value as the typical soil, but is probably better adapted to truck crops, and not so well suited to citrus fruits.

#### PLUMMER FINE SAND.

The Plummer fine sand to a depth ranging from 8 to 20 inches consists of a light-gray to dull-gray fine sand, low in organic matter. The surface layer is moderately compact and underlain by material similar in texture, though of a lighter gray color. It is not uncommon for the subsoil to be dingy gray, sometimes almost white, and in the depressions the lower part of the 3-foot section may be mottled with brown or yellow. The subsoil is almost continually saturated, and has the characteristics of quicksand when removed from its natural position. When in place it is always very compact.

The type is subject to considerable range in texture, and as mapped probably includes some areas of Plummer sand, which differ only in texture. In a few places where the organic content is higher than the average, the upper 3 or 4 inches of soil are dark gray in color and much like the Portsmouth soils.

The Plummer fine sand occurs throughout the flatwoods region of the county, and is often developed around lakes and ponds. The areas are usually small and irregular in outline. They are particularly numerous in the section northwest, west, and southwest of Taft, and east of Conway. The type is also found southwest of

Zellwood and around Lake Aldrich. Numerous areas, usually small, are scattered throughout the flatwoods in the eastern half of the county.

A flat surface is characteristic of this soil, which is usually found in shallow depressions with very poor drainage. In wet weather the surface is frequently covered with water. In many places the soil is treeless, the vegetation consisting of a dense growth of grasses and sedges. In other places there is a cover of scattered longleaf pine, a few palmetto, and gallberry, but these growths are generally confined to the slightly higher areas. The type affords some grazing, but is not used for agriculture.

*Plummer fine sand, cypress-swamp phase.*—The cypress-swamp phase differs from the typical Plummer fine sand mainly in its dense stand of cypress. The surface soil is usually a light-gray fine sand, but in places it is dark gray as a result of the accumulation of organic matter. The subsoil is usually light gray in color, very compact, and always saturated with water.

This phase occupies scattered, irregular areas closely associated with the poorly drained soils throughout the eastern half and southern part of the county. Areas are mapped south of Fairville, in the vicinity of Manns Lake, southwest of Clear Lake, and southeast of Conway. The phase is confined to ponds and depressions, and is covered with water during the greater part of the year. No agricultural development has taken place.

#### PORTSMOUTH FINE SAND.

The surface soil of the Portsmouth fine sand, extending to a depth of 8 to 16 inches, is typically a black to very dark gray fine sand, with a rather friable structure. It contains a high percentage of organic matter and is rather loamy and easy to cultivate. The subsoil is similar in texture to the surface soil and is light gray in color. It is usually saturated with water, but is rather compact and resembles quicksand when removed from its natural position.

This is not an extensive soil. It usually occurs in small, irregular areas around lakes, and in depressions and ponds, and is most extensive in the section north of Apopka, in the northwestern part of the county between Zellwood and Wekiva Springs, and in the southeastern corner along the St. Johns River. Scattered areas are found in the vicinity of Piedmont, east of Clarcona, and northwest of Fairville. The type also occurs to a small extent east of Crooked Lake, west of Lake Hancock, and around Johns Lake, Lake Conway, and Lake Holden.

The Portsmouth fine sand is a flat, low-lying soil, poorly drained and wet the greater part of the year.

Very little of the type is under cultivation, principally on account of the poor drainage. In other parts of the State the Portsmouth soils have been reclaimed in many places and used in the production of truck crops. The native vegetation consists largely of grasses, such as broom sedge and sword grass and other water-loving grasses. A few areas support a swamp growth of cypress and bay. The type in its present condition affords some grazing during part of the year.

#### LEON FINE SAND.

The Leon fine sand, to a depth of 12 to 24 inches, is typically a light-gray to almost white fine sand which becomes medium or dark gray in color when wet. It contains relatively little organic matter, and is rather compact. Below the surface soil is a hardpan stratum, from 2 to 10 inches thick, consisting of a dense, compact layer of rusty-brown or dark-brown to almost black fine sand, very high in organic matter. It is quite impervious, even hard to penetrate with the soil auger, and prevents the capillary rise of moisture during periods of drought. It is underlain by a light-gray or white loose fine sand, usually saturated, which has the characteristics of quicksand. Just beneath the hardpan, however, the material is more or less stained with brown, and in places there is a light-brownish or yellowish-gray zone above the typical material.

The Leon fine sand is subject to considerable textural variation. In the southwestern part of the county it includes numerous areas of sand, which have the same agricultural value and differ from the typical soil only in texture. In various places in the eastern half of the county small areas are encountered which occupy slightly higher elevations than the typical and have better drainage. The surface soil here is much like that of the St. Lucie soils, and is looser, lighter colored, and deeper above the hardpan stratum than is the case in the average development of the Leon fine sand. The vegetation in such areas also approaches that of the St. Lucie, and the soil appears to be a gradation between the Leon and St. Lucie fine sands. The Leon fine sand also is closely associated with the St. Johns soils, and doubtless in the regions where the organic content is above the average it includes small areas of the St. Johns fine sand.

The Leon fine sand is the most extensive soil in Orange County, and the predominating soil in the central and southern parts of the survey. It is known locally as "palmetto flatwoods." It is most extensive between the St. Johns River and Lake Osceola, near and south of Lake Conway, and near Clear Lake and Turkey Lake. Numerous areas are mapped in the southwestern part of the county. The type is also found southwest of Winter Garden and west of

Zellwood, and numerous small areas occur west of Orlando and Maitland.

While the Leon fine sand normally lies slightly higher than the Portsmouth and St. Johns soils, it occupies flat to nearly level areas, and as a whole has very poor drainage. During rainy seasons it is saturated, and it is not uncommon to find areas covered with water for short periods.

The vegetation consists largely of longleaf pine, gallberry, saw palmetto, wire grass, and runner oak. The wire grass affords some grazing, and the pine is valuable as a source of turpentine and lumber. It is in most places difficult and quite costly to reclaim this land for cultivation. Very little of it is farmed, and it is considered a very uncertain soil, of low productiveness. The small content of organic matter, the loose, open structure of the surface soil, and the hardpan stratum, preventing the rise of capillary moisture, make this a very droughty soil. With an irrigation and drainage system, however, and the liberal use of fertilizers it can be used for trucking, but at best it must be well and intensively handled to give satisfactory results. The soil, which is easily tilled, has a tendency to become loose and incoherent under cultivation.

Land values depend largely upon the stand of pine and the location with respect to towns and county roads. The price of virgin areas, ranges from \$5 to \$25 an acre.

#### ST. JOHNS FINE SAND.

The St. Johns fine sand in its typical development has a surface soil of dark-gray to black, rather friable fine sand, 8 to 16 inches deep. Frequently the upper 4 inches is darker in color than the lower part of the surface soil, owing largely to a greater content of organic matter. In uncleared areas the surface soil appears moderately compact, but, as in the case of the Leon soils, it becomes looser and more incoherent with cultivation. The soil on the whole contains more organic matter than the Leon fine sand. It is underlain by a compact, hardpanlike stratum of dark-brown or almost black fine sand, which varies in thickness from 3 to 12 inches. This material is high in organic matter. It becomes very compact and hard in dry weather, but softens slightly when wet. It is very difficult for roots to penetrate, and during droughts it prevents the rise of moisture from below. This stratum is underlain by a yellowish to brownish-gray fine sand which quickly passes into a light-gray or almost white fine sand, very similar to the lower subsoil of the Leon soils. It is usually saturated, and is much like quicksand.

The St. Johns fine sand is subject to considerable range in texture, and as mapped includes several areas of medium sand, occurring



mostly in the southwestern part of the county. On account of its close association with the Leon soils, it doubtless includes small areas of the Leon fine sand.

The St. Johns fine sand occupies large areas in the eastern half of the county. The largest areas occur between the southern county boundary and Bithlo. A large area is mapped near the southeastern corner of the county, and small areas along Reedy Creek, between Golden Rod and Orlando, and in the vicinity of Christmas.

A flat, nearly level topography and very poor drainage characterize this soil. Saucerlike depressions and small swamps are common throughout the larger areas, and frequently during wet weather water stands on much of the type.

The native vegetation consists largely of longleaf pine, gallberry, saw palmetto, and a little wire grass. The pine is generally larger than on the Leon fine sand, and the palmetto growth is usually more rank and dense.

At the present time practically none of the St. Johns fine sand is used for agriculture. To bring it into a good state of cultivation would be very expensive, involving clearing, draining, and installing an irrigation system. The soil is adapted to the same type of agriculture as the Leon fine sand, and in its present condition has a similar selling value.

#### BLADEN FINE SAND.

The Bladen fine sand, to a depth of 6 to 12 inches, is a light-gray to brownish-gray or dark-gray fine sand, normally containing enough organic matter to make it loamy and moderately coherent. The soil is underlain by a gray or grayish-brown fine sand subsoil, which becomes ocher yellow, orange yellow, or brownish in the lower part of the 3-foot section. In many places a dingy-brown material is encountered above the yellow and the lower subsoil is drab, mottled with brown and yellow. The subsoil is very compact and in the upper part resembles quicksand. Lenses of clay or sandy clay are present below 30 inches in many of the areas, and in most places the lower subsoil has considerable coherence.

The type is subject to much variation. It occurs in inaccessible regions and in that part of the county which, owing to inundation at the time of the survey, was not mapped in detail. Some areas of Portsmouth and Plummer soils are undoubtedly included. Small, unimportant areas may occur which have a calcareous subsoil. The type is subject to a wide range in texture and includes a number of small areas of Bladen sand.

The Bladen fine sand is confined to the eastern part of the county, where it is found in close association with the Bladen fine sandy loam. It is the more extensive of the two types. It occupies flat

areas at levels below the St. Johns and Leon soils. It is generally water-soaked, and water stands on the greater part of the type during periods of rainy weather.

The native vegetation includes cabbage palmetto, slash pine, and scattering clumps of saw palmetto and coarse grasses, the latter affording some grazing. The type is not used for agriculture, but with adequate drainage and proper handling truck crops and corn could apparently be produced with profit.

*Bladen fine sand, hammock phase.*—The hammock phase of the Bladen fine sand includes areas covered with a dense hammock growth of such character that it would be difficult and very expensive to clear them for cultivation. Two types of hammock are included. The dry hammock areas usually support a thick growth of cabbage palmetto, and are slightly higher than the average, with a little better drainage. Frequently the subsoil is calcareous. The wet hammock areas are very low and semiswampy, with a growth of maple, gum, and cypress, and a thick underbrush. The soil of the wet hammock is usually water-soaked, and standing water is present during most of the year. In other features the hammock areas, both dry and wet, are quite similar to the typical Bladen fine sand.

*Bladen fine sand, prairie phase.*—Parts of the Bladen fine sand are treeless and covered with a dense growth of grass. Owing to the fact that these areas can be brought into cultivation much more easily than the typical Bladen fine sand, they are separated as a prairie phase. The phase is quite similar to the typical Bladen fine sand, although it occupies a slightly lower elevation and is covered with water for longer periods. It is confined entirely to the prairies near the St. Johns River.

#### BLADEN FINE SANDY LOAM.

To a depth of 12 to 24 inches the Bladen fine sandy loam is a dark-gray to brownish-gray, and in some places almost black, loamy fine sand. The subsoil is a tough, compact, tenacious clay or heavy sandy clay, gray or drab in basic color and mottled with brown, reddish brown, and bright yellow. The depth to the clay subsoil is variable, but in most areas is between 15 and 24 inches, dropping in extreme cases to 36 inches. In a few localities the type varies in having a calcareous, mealy subsoil.

As mapped, the Bladen fine sandy loam includes some small bodies of Bladen fine sand and sand, and the areas in the eastern part of the county, which were of necessity mapped in a general way, include some developments of Portsmouth and Plummer soils. Small areas of Muck and Peaty muck are also included in places.

The Bladen fine sandy loam occurs in close association with the Bladen fine sand, and is often found near the mouth of streams enter-

ing the St. Johns River prairies or in narrow strips along the main stream courses. The largest areas lie in the eastern part of the county. A few small areas are mapped along the Contoohatchee River, and southwest of Taft, and small patches occur in the vicinity of Winter Garden.

The type occupies flat or nearly level areas whose drainage is poorly established. It is wet throughout the greater part of the year, and water stands on the surface for considerable periods after heavy rainfalls. The forest growth consists principally of slash pine, and a scattered growth of cabbage palmetto. Clumps of saw palmetto are occasionally seen on the higher lying areas. There is a heavy growth of bunch grass and sword grass over part of the type.

Some small areas included with this type really represent a hammock variation. They are covered with a dense growth of cabbage palmetto in the higher situations, and maple, gum, magnolia, and cypress in poorly drained areas. There is also included a small acreage of a prairie variation, on which there is no tree growth, its place being taken by a luxuriant growth of coarse grasses, particularly sword grass. The cost of bringing these prairie areas under cultivation would be much less than in the case of the typical soil or the hammock areas.

The Bladen fine sandy loam is not used for agriculture. Cattle graze on it in a few places, particularly in the vicinity of Winter Garden. The greater part of the type requires artificial drainage before it can be profitably used for crop production, but with adequate drainage, thorough aeration, and the liberal use of lime, it should be well suited to the production of truck crops, Irish potatoes, and corn. In the vicinity of Hastings (St. Johns County) and in other places in Florida this has been found a desirable Irish-potato soil. It retains moisture well and is easy to cultivate.

#### PEAT.

Peat consists of brown, partially decomposed vegetable matter, fibrous to semifibrous, and generally uniform in texture throughout the 3-foot section. In places, however, there is a poorly defined stratification, layers of black, well-decomposed Peat being encountered. Drainage and cultivation tend to cause rapid decomposition of the surface material, changing it to black, more thoroughly decomposed Peat. The depth of the organic material is variable, ranging from 2 to 25 feet or more.

Two large areas of Peat are mapped, one north of Lake Apopka, near Zellwood, and the other in the southern part of the county east of Hart Lake. Both areas are practically level and very poorly drained, water normally standing several inches deep over the entire area. In recent years part of the Peat has been artificially

drained, and a small proportion of the reclaimed area has been farmed. The prairie vegetation, consisting chiefly of saw grass, has been cleared away and the land plowed and cultivated, chiefly with tractors.

It has been found that Peat is difficult to use as an agricultural soil. It contains very little available plant food and the vegetation is nearly always of a character denoting acidity and sterility of the soil.<sup>4</sup> The capillarity of Peat is poor, and the wilting point very high, so that unless the water table is maintained relatively near the surface crops suffer from drought. The nature of the material and the topographic position of the Peat areas make the type especially susceptible to frost.

Agricultural use of Peat depends upon proper drainage, with constant control of the water table; a careful selection of crops adapted to this kind of material and to the local climatic conditions, and the application of manure or mineral fertilizers, especially lime and potash.

#### PEATY MUCK.

The areas classified as Peaty muck consist of vegetable matter in process of decay. The immediate surface layer usually consists of disintegrated leaves, roots, and stems, beneath which is a layer of brown woody Peat. Below this, at depths of 12 to 20 inches, black muck or Peaty muck, representing a further stage of decay, is encountered. The depth and character of the substratum are variable. Typically it is a black, mucky fine sand, and throughout most of the areas is found at depths of 2 to 3 feet.

The Peaty muck, as mapped, includes considerable areas of typical brown Peat, uniform to a depth of 3 feet or more. Much of the unclassified material in the Swamp of this county is Peaty muck.

Areas of Peaty muck are found in all parts of Orange County. Two of the largest occur south of Lake Sheen and around Lake Speer. Most of the areas are comparatively small, shallow depressions, locally known as "bays." Drainage is poor, and water stands in the depressions most of the time. The vegetation is denser than on any other soil in the county. It consists typically of pond cypress, slash pine, black gum, red maple, sweet bay, titi, myrtle, and bamboo vine, with numerous species of herbaceous plants, ferns, and one or more species of sphagnum moss. The dense vegetation, together with the poor natural drainage, has prevented any extensive utilization of Peaty muck. The cost of draining and clearing the few acres which have been brought under cultivation is said to have been \$300 to \$500 an acre. The reclaimed areas are used for the production of truck crops.

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<sup>4</sup> Roland M. Harper, Third Annual Report, Florida State Geological Survey (1910), p. 310.



## MUCK.

Muck consists of black, finely divided and well-decomposed vegetable matter with a comparatively high percentage of fine sand, silt, and clay. The average ash content of typical Muck is about 40 per cent of the oven-dried sample, as compared with 6 to 15 per cent in the case of Peat. When wet the material is somewhat sticky, plastic, and compact. Over most of the areas mapped the immediate surface material is brown fibrous Peat, which if dried out would not average more than 1 or 2 inches in thickness. The organic material in the areas of Muck varies in depth from 1 to 3 or more feet, and is underlain by fine sand, fine sandy clay, or clay.

Muck in Orange County is confined to the vicinity of the St. Johns River and Hart Lake. The surface is level and poorly drained, the type being covered with water during periods of wet weather. The areas along the St. Johns River support a prairie vegetation consisting almost entirely of a species of *Spartina*, commonly called bunch grass or sword grass.

At present none of the Muck is under cultivation, and extensive drainage operations are necessary before the land can be reclaimed. Of the cumulose soils, however, Muck is the most valuable for agricultural purposes, its worth being fully recognized in other counties in Florida and in other parts of the United States. It is especially adapted to the production of cabbage and onions. Beans, Irish potatoes, eggplant, lettuce, and peppers have given satisfactory yields in other parts of the State.

## SWAMP.

Swamp includes poorly drained soils along the stream courses, and in swales and poorly drained depressions where water flows or stands throughout the greater part of the year. The narrow areas bordering the water courses usually are slightly lower than the adjoining land and serve as channels for the stream. The soil material is subject to wide variation, even within short distances. Peat, Peaty muck, and Muck may occur in some places, but the prevailing soils are sands and fine sands.

As a whole, the Swamp is water-soaked and without any agricultural value in its present condition. The growth is usually very dense and consists largely of cypress, some maple and gum, and bay, with a heavy undergrowth.

In the southwestern part of the county, near the heads of Reedy Creek and Shingle Creek, the Swamp includes small pine-covered islands occupied by the St. Johns and Leon soils. On account of the small extent and inaccessibility of these areas it was not attempted to map the various soil types. In Wekiva Swamp, west of Wekiva

River, small areas of the Bladen soils are included. Areas of this Swamp are not so wet as typical, but there are numerous wet hammocks. The vegetation here includes much cabbage palmetto.

#### WATER AND GRASS.

The type mapped as Water and grass is very small in extent, and is confined to shallow ponds throughout the county which support a vigorous growth of water-loving grasses and sedges. The areas are covered with water throughout most, if not all, of the year, and embrace soils subject to wide variation in color, structure, and texture. Usually the surface soil is dark gray, and it is not uncommon to find Peaty muck in places. The subsoil is generally lighter in color than the surface soil. It ranges in texture from sand to fine sand, and is quite similar to quicksand in structure. This land affords a little grazing, but has no agricultural value.

#### SUMMARY.

Orange County is situated in the north-central part of the Florida peninsula and comprises an area of 899 square miles, or 575,360 acres. In this survey all that part of the county west of range 32 east was mapped in detail, while the remainder was covered in reconnaissance.

The county is level to gently rolling and comprises two distinct physiographic regions—the lake region in the northwestern part of the county and the flatwoods in the eastern and southern sections. The range in elevation is from 15 or 25 feet along the St. Johns River to more than 125 feet in parts of the lake region.

The drainage of the lake region is generally good, although chiefly underground. That of the flatwoods region is very poor; the soil is usually saturated, and stream flow is sluggish.

The greater part of the county is drained into the Atlantic Ocean through the St. Johns River and its tributaries. The southwestern part of the county drains into Lake Okeechobee through tributaries of the Kissimmee River.

Orange County was organized about 1856. The population of the county in 1920 was 19,890. The population of Orlando, the county seat and largest town, is 9,282.

Good transportation facilities are afforded the greater part of the county by the Atlantic Coast Line, Seaboard Air Line, and Florida East Coast Railroads. The main traveled highways are usually good, and the county has about 70 miles of brick road.

The climate is mild and of a subtropical character. It attracts many tourists and healthseekers during the winter season. The mean

annual precipitation is 51.57 inches. The highest temperature on record is 101° F., and the lowest is 18° F. The mean annual temperature is 71.7° F.

Agriculture in this region began with the first settlement and comprised only subsistence crops. During the seventies commercial plantings of citrus trees were made, and the development of an important citrus-fruit industry began. Later, trucking was taken up, and this industry is developing rapidly. Lettuce, cucumbers, cabbage, and Irish potatoes are the principal truck crops.

The live-stock industry began early and has always been rather important. At the present time the greater part of the county is used to some extent for grazing. Corn is the most important field crop. Cowpeas and velvet beans are grown to a considerable extent, and beggarweed, crab grass, and cowpeas are used for hay.

The 1920 census reports 40.8 per cent of the total area of the county in farms, and 29.1 per cent of the farm land as improved. The average size of the farms is given as 221.8 acres.

The soils of the county are separated into 8 series, comprising 10 types and 5 phases, and into Peat, Peaty muck, Muck, Swamp, and Water and grass.

The St. Lucie fine sand is white in color and excessively drained. It supports a scrubby, semiarid vegetation, and for agricultural purposes is very poor or almost worthless.

The Norfolk sand and fine sand are gray at the surface, with a pale-yellow subsoil. They occupy slightly rolling areas and are well drained. They are well adapted to citrus fruits and are used extensively for their production.

The Orlando fine sand and its black phase are well-drained soils more nearly level than the Norfolk soils and used extensively for citrus fruits and truck crops. They are among the best soils in the county.

The soils of the Plummer, Portsmouth, Leon, St. Johns, and Bladen series have poor drainage and are little used for agriculture.

The cumulose soils of the county comprise Peat, Peaty muck, and Muck. Only a very small proportion of their area has been reclaimed, but Muck has considerable agricultural possibilities.

Swamp and Water and grass represent mixed and varied soil material, nonagricultural in character.



[PUBLIC RESOLUTION—No 9.]

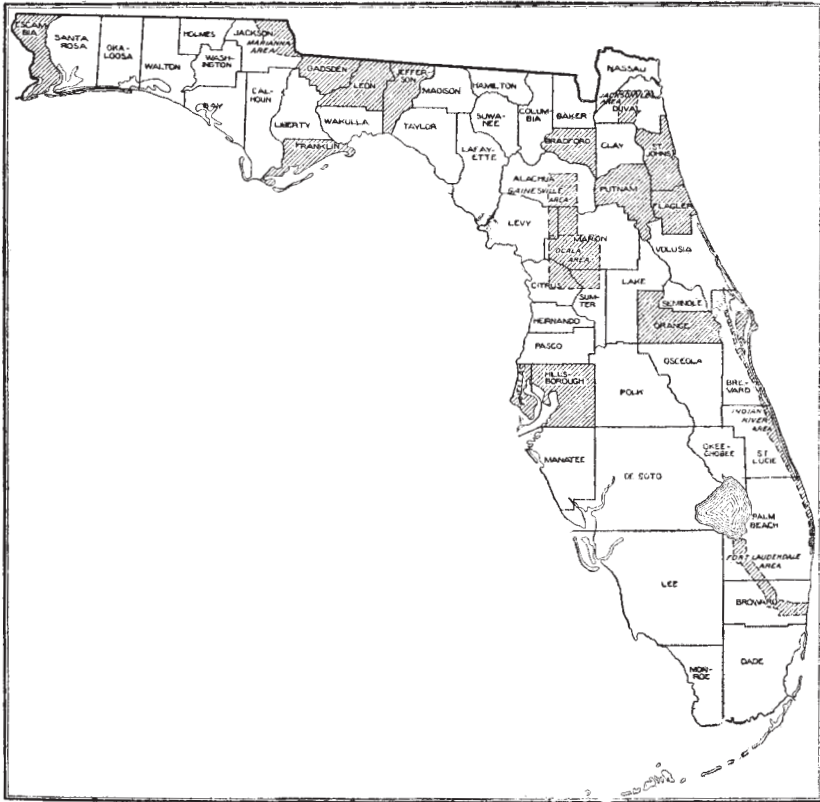
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

*Resolved, by the Senate and House of Representatives of the United States of America in Congress assembled,* That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Florida, shown by shading.

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